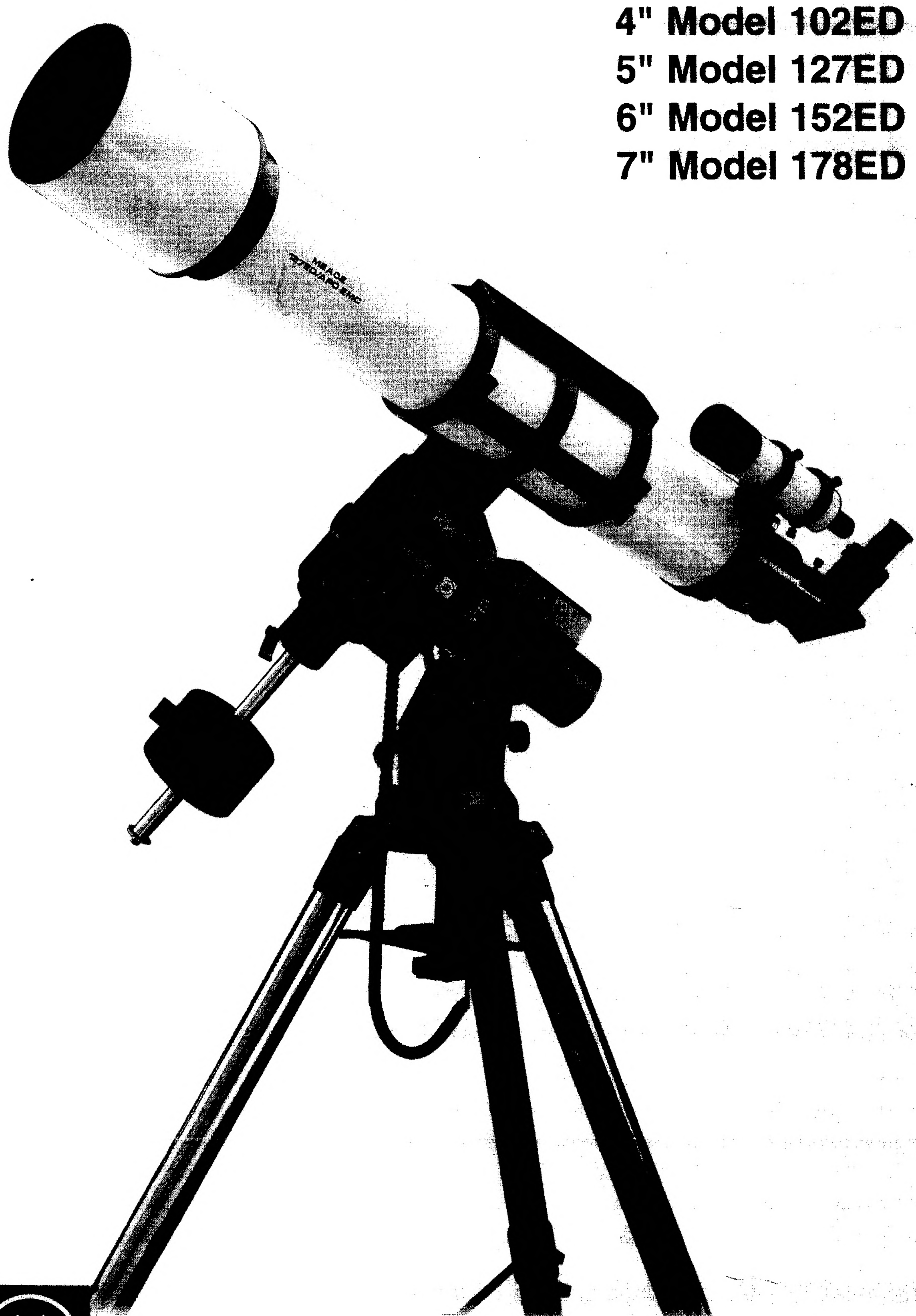
Instruction Manual

Meade® *ED* Apochromatic Refractors

4" Model 102ED
5" Model 127ED
6" Model 152ED
7" Model 178ED



Meade Instruments Corporation
6001 Oak Canyon, Irvine, California 92618 ■ (949) 451-1450

WARNING

NEVER ATTEMPT TO OBSERVE THE SUN THROUGH YOUR MEADE TELESCOPE! OBSERVING THE SUN, EVEN FOR THE SHORTEST FRACTION OF A SECOND, WILL CAUSE INSTANT AND IRREVERSIBLE EYE DAMAGE. WHEN OBSERVING DURING THE DAYTIME, DO NOT POINT THE TELESCOPE EVEN CLOSE TO THE SUN.

DO NOT PLUG OR UNPLUG THE KEYPAD FROM THE POWER PANEL OF THE TELESCOPE WHILE THE POWER IS ON.

ALL MEADE TELESCOPES ARE UNDER CONTINUOUS TECHNICAL REVIEW, AND SPECIFICATIONS MAY BE CHANGED WITHOUT NOTICE. WE RESERVE THE RIGHT TO SHIP OUR LATEST MODELS.

Meade Limited Warranty

Meade telescopes, spotting scopes, and accessories are warranted to be free of defects in materials and workmanship for a period of **ONE YEAR** from the date of original retail purchase in the U.S.A. Meade Instruments will repair or replace a product, or part thereof, found by Meade to be defective, provided the defective part is returned to Meade, freight prepaid, with proof of purchase. This warranty applies to the original purchaser only and is non-transferable. Meade products purchased outside North America are not included in this warranty, but are covered under separate warranties issued by Meade International Distributors.

RGA Number Required: Prior to the return of any product or part, a Return Goods Authorization (RGA) number **must** be obtained by writing to Meade, or by calling (949) 451-1450. Each returned part or product must include a written statement detailing the nature of the claimed defect, as well as the owner's name, address, phone number, and a copy of the original sales invoice.

This warranty is not valid in cases where the product has been abused or mishandled, where unauthorized repairs have been attempted or performed, or where depreciation of the product is due to normal wear-and-tear. Meade specifically disclaims special, indirect, or consequential damages or lost profit which may result from a breach of this warranty. Any implied warranties which can not be disclaimed are hereby limited to a term of one year from the date of purchase by the original retail purchaser.

This warranty gives you specific rights; you may have other rights which vary from state to state.

Meade reserves the right to change product specifications or to discontinue products without prior notice.

This warranty supersedes all previous Meade product warranties.

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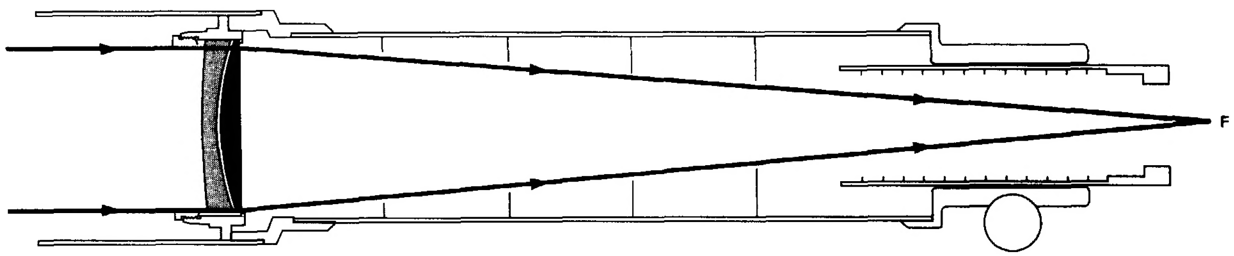
Ver. 12-99-1 Part Number 14-0202-00

Note

Information on optional accessories is not included in this manual. For details in this regard, see the latest Meade Telescope Systems and Accessories Catalog.

The Meade *ED* Apochromatic Optical System (Diagram not to scale)



In the Meade *ED* Apochromatic design, light enters from the left, passes through the hard KF3 (light gray) glass element of the objective lens, then through the ED (darker gray) glass element and focuses at F. The *ED* glass element permits the optical designer, by a precisely-computed combination of lens surface radii and air-spacing distance between the elements, to bring all visible wavelengths (colors) of light to virtually the same focus.

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IMPORTANT NOTE: Your Meade *ED* Apochromatic Refractor is a precision instrument. For your own safety, and to avoid potential damage to the telescope itself, do not attempt to set-up or operate the telescope before thoroughly reading the contents of this instruction manual.

A. INTRODUCTION

1. Optics

In early 1991 Meade engineers and opticians set out to develop the most advanced, mid-aperture apochromatic refractors ever made available to the amateur or professional astronomer. In studying all of the glass-types and designs available, it rapidly became clear to Meade optical designers that an air-spaced ED-glass doublet objective lens met all of the required design criteria: apochromatic performance with absolutely superb color corrections at all photo-visual wavelengths, even at the highest magnifications; relatively light weight for rapid thermal equalization; and excellent durability and resistance to weathering.

The objectives included with Meade *ED* apochromatic refractors are manufactured entirely at the Meade Irvine facility and utilize the highest-grade optical glasses available; they are free of striae and other imperfections that can degrade optical performance. Each lens is individually manufactured, pitch-polished, and hand-figured by a master optician to reach the highest levels of resolution, contrast, and correction obtainable.

2. Equatorial Mount

As important to the serious observer as superb imaging performance, all-new Meade LXD 650 and LXD 750 German-type equatorial mountings, manufactured at the Meade Irvine factory, will revolutionize forever the way amateur astronomers think about telescope mounting platforms. Standard features include:

- Massive polar and declination castings with oversize thrust surfaces.
- Worm-gear tracking and microfine manual slow-motion controls in both R.A. and Dec.
- Eight ball bearings (4 on each axis) carry even heavy loads with supreme precision.
- Micrometric azimuth and elevation controls permit precise polar alignment.
- Superstable field tripods, including the Meade Giant Field Tripod supplied with LXD 750 equatorial mounts.

3. Optional Drive Systems

Two dual-axis, DC-servo-motor-controlled electronic drive systems are available for the LXD 650 and LXD 750 mounts.

The #1697 Computer Drive System (CDS) offers an electronic package which permits the location and observation of the major planets as well as hundreds of deep-sky objects the very first night you use the telescope. Even for the experienced amateur the telescope's pushbutton electric slewing, digital readouts, Smart Drive, and much more, open up visual and photographic capabilities heretofore undreamed of. See the Meade General Catalog for more details.

For users not requiring the wide-ranging capabilities of the #1697 CDS, the #1664 Electronic Drive System (EDS) presents the observer basic telescope functions including 2-speed dual-axis controls, Smart Drive, map light, and others. See the Meade General Catalog for more details.

4. Standard Equipment

Model Number	102 ED	127 ED	152 ED	178 ED
Aperture	4" (102mm)	5" (127mm)	6" (152mm)	7" (178mm)
Focal Length	36" (920mm)	45" (1140mm)	54" (1370mm)	63" (1600mm)
Focal Ratio	*f*/9	*f*/9	*f*/9	*f*/9
Multi-Coated Optics	Yes	Yes	Yes	Yes
Handles on Rear Cell	No	No	Yes	Yes
Focuser	#684 (2.7" I.D.)	#684 (2.7" I.D.)	#684 (2.7" I.D.)	#684 (2.7" I.D.)
Viewfinder	8x50	8x50	8x50	8x50
Diagonal	#930 (2" - 1 1/4")	#930 (2" - 1 1/4")	#930 (2" - 1 1/4")	#930 (2" - 1 1/4")
Eyepiece	Series 4000 SP26mm (35x)	Series 4000 SP26mm (44x)	Series 4000 SP26mm (53x)	Series 4000 SP26mm (62x)
Equatorial Mount	LXD 650	LXD 650	LXD 750	LXD 750
Azimuth Control	Yes	Yes	Yes	Yes
Elevation Control	Yes	Yes	Yes	Yes
R.A. Lock	Yes	Yes	Yes	Yes
Dec. Lock	Yes	Yes	Yes	Yes
Setting Circles	Yes	Yes	Yes	Yes
Latitude Scale	Yes	Yes	Yes	Yes
Tripod	Field Tripod	Field Tripod	Giant Field Tripod	Giant Field Tripod
Counterweight(s)	1 - 10lb.	1 - 15lb.	1 - 25lb.	1 - 12lb. 1 - 25lb.
Retractable Counter-weight Shaft	Yes	Yes	Yes	Yes
Instruction Manual	Yes	Yes	Yes	Yes

B. TELESCOPE ASSEMBLY

Use the following steps to assemble your telescope.

1. Unpacking

Meade APO refracting telescopes are packed in five cartons as follows:

Carton #1:
- The complete optical tube assembly (OTA) with cradle rings and dew shield. (Note: The 7" APO only has the dew shield packed separately in Carton #3.)

Carton #2:
- The complete equatorial head with field tripod adapter.

Carton #3: (Accessories)
- 8 x 50mm straight-through viewfinder with quick-release bracket.
- #930 2" - 1 1/4" Diagonal Mirror.
- Series 4000 SP26mm eyepiece.

Carton #4:
- Counterweight(s)

Carton #5:
- Field Tripod (4" and 5") or Giant Field Tripod (6" and 7").

Carefully unpack and remove all the telescope parts from their packing material. Compare the parts to the "Packing Program" (packed with the telescope) to identify each part (refer to Fig. 4).

NOTE: We strongly recommend that you keep all packing materials. If it is ever necessary for you to return your telescope to the Meade factory for servicing, these materials will help ensure that no shipping damage will occur.

2. The Field Tripod

The Field Tripods for the Meade APO refracting telescopes are supplied as completely assembled units, except for the spreader bar (4, Fig. 1) and the 6 lock knobs (5, Fig. 1) (2 knobs for each of the 3 tripod legs) used to adjust the height of the tripod. These knobs are packed separately for safety in shipment.

After removing the field tripod from its shipping carton, stand the tripod vertically, with the tripod feet down and with the tripod still fully collapsed (see Fig. 2). Grasp two of the tripod legs and, with the full weight of the tripod on the third leg, gently pull the legs apart to a fully open position.

Thread in the 6 lock-knobs (2 on each tripod leg) near the foot of each tripod leg. Refer to Fig. 1. These lock-knobs are used to fix the height of the inner, extendible tripod leg section. **Note: "Firm feel" tightening is sufficient; over-tightening may result in stripping of the knob threads or damage to the tripod legs and results in no additional strength.**

The spreader bar (4, Fig. 1) has been removed for shipment. To install, first remove the hex nut from the top of the threaded rod (2, Fig.1) and remove the threaded rod from the tripod head (1, Fig. 1). [Note: the threaded rod has a knob (3, Fig. 1) permanently attached.] Remove the second hex nut from the threaded rod. These two hex nuts will not be used.

Slide the spreader bar onto the threaded rod (note the correct orientation as shown in Fig. 2) and position the threaded rod back through the tripod head. Place the clip retainer (a "C" clip) into the slot in the threaded rod. This clip holds the threaded rod in place. See Fig. 2.

Position the spreader bar so that the 3 arms of the spreader bar are lined up with the 3 tripod legs.

Attach the equatorial head as described on page 9.

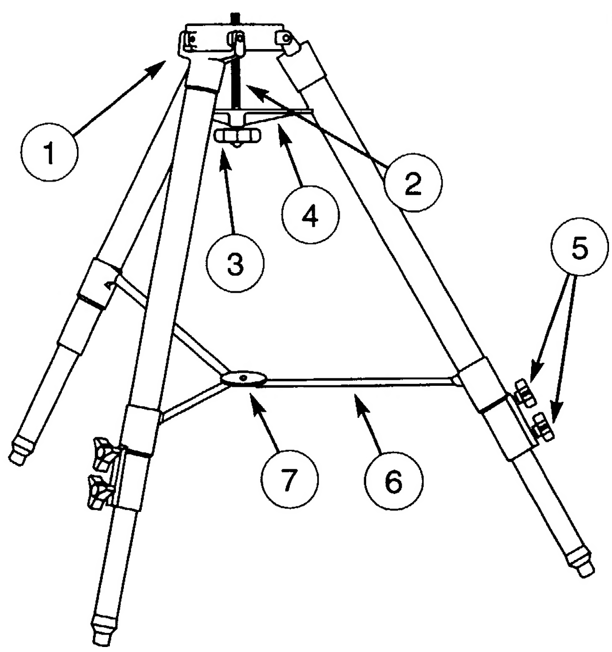
To vary the tripod height, loosen the 6 lock-knobs and slide the 3 inner tripod leg sections out to the desired height. A bubble level is included on both the LXD 650 and LXD 750 mounts to aid in leveling the field tripod.

To collapse the tripod (after removing the telescope and equatorial mount) for storage, follow these steps:

1. Lower the tripod legs to the lowest position.
2. Rotate the spreader bar (4, Fig. 1) 60° from its assembled position, so that one spreader bar arm is located between each adjacent pair of tripod legs.
3. At the base of the tripod is a 3-vane extension strut system, with a circular hub at its center (7, Fig. 1). To collapse the tripod, grasp the tripod head (1, Fig 1) with one hand and, with the other hand, pull directly "up" on the central hub of the extension strut system. This operation will cause the tripod legs to move inward to a collapsed position.

PRECAUTIONARY NOTES

1. If the tripod does not seem to extend or collapse easily, do not force the tripod legs in or out. By following the instructions above, the tripod will function properly, but if you are unclear on the proper procedure, forcing the tripod into an incorrect position may damage the extension strut system.
2. Do not overtighten the 6 lock-knobs used to fix the inner tripod leg sections at various heights. "Firm feel" tightening is sufficient.



(1) Tripod Head
(2) Threaded Rod
(3) Tension Knob
(4) Spreader Bar
(5) Lock Knobs
(6) Extension Strut
(7) Tension Hub

Fig. 1: Field Tripod

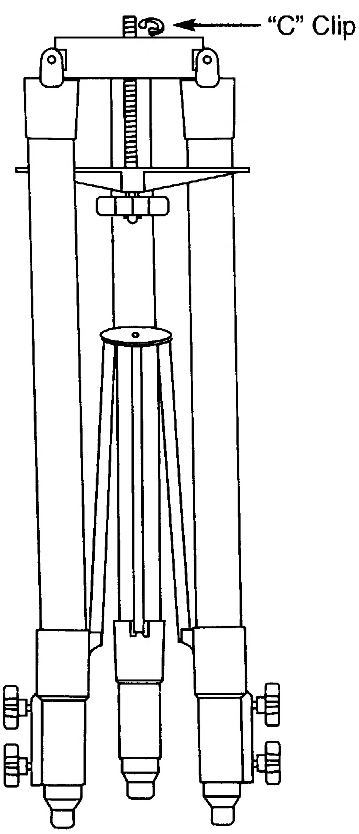
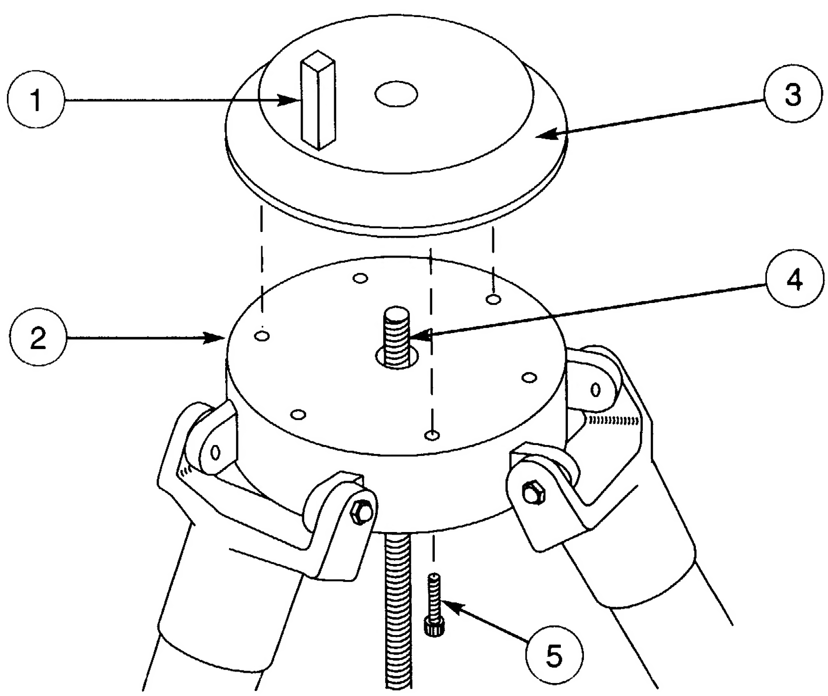


Fig. 2: Field Tripod (collapsed)

3. Mounting the Equatorial Head to the Field Tripod

To attach the equatorial head to the field tripod, follow these steps:

1. Remove the field tripod adapter (13, Fig. 4; also 3, Fig. 3) from the bottom of the equatorial head. This has been shipped attached to the equatorial head to prevent damage to the azimuth stud (1, Fig. 3). Loosen the azimuth knobs (12, Fig. 4) slightly to release the field tripod adapter.
2. Attach the field tripod adapter to the field tripod using the three 1/2"-20 screws supplied. (These three screws are shipped with the field tripod adapter.) Align the azimuth stud with one of the tripod legs as shown in Fig. 3, and thread the three screws up through the bottom of the tripod head and into the bottom of the field tripod adapter. Firmly tighten the three screws, so that the tripod head and the field tripod adapter are rigidly connected. The field tripod adapter may be left permanently attached to the field tripod.
3. Place the equatorial head onto the top of the field tripod adapter. Be sure the two azimuth knobs are unthreaded far enough to allow the equatorial head to slide past the azimuth stud.
4. Thread the threaded rod (2, Fig. 1) up into the equatorial head using the tension knob (3, Fig. 1). Be sure to keep the spreader bar aligned with the tripod legs as the field tripod and equatorial head combination tightens up. Tighten the tension knob to a "firm feel," over-tightening may deform the tripod legs and does not result in a more rigid system.



(1) Azimuth Stud
(2) Tripod Head
(3) Field Tripod Adapter
(4) Threaded Rod
(5) 1/4"-20 Attachment Screw

Fig. 3: Attaching the Field Tripod Adapter

4. Attaching the Counterweight(s)

1. The equatorial head has been shipped with the latitude angle roughly set to 0°. In this "shipping" position, the counterweight will not clear the tripod leg, therefore, the latitude angle should be set before the counterweight can be attached. Loosen the latitude lock lever (11, Fig. 4) and turn the latitude adjustment knob (5, Fig. 5) until the latitude scale indicates the correct latitude of your viewing location. (Determine the latitude of your viewing location by checking a road map or atlas.) Retighten the latitude locking lever.
2. Loosen the counterweight shaft locking lever (12, Fig. 5) and lower the counterweight shaft (9, Fig. 5). Lock into place by retightening the counterweight shaft locking lever.
3. Remove the counterweight safety stop (8, Fig. 5) from the end of the counterweight shaft.
4. Slide the one (or two) counterweights (10, Fig. 5) onto the counterweight shaft and lock into place by tightening the counterweight lock lever (7, Fig. 5).
5. Replace the counterweight safety stop onto the end of the counterweight shaft.

CAUTION: Never operate the telescope without the counterweight safety stop in place.

5. The Dew Shield

The 4", 5", and 6" APO telescopes have been shipped with the dew shields (1, Fig. 4) already installed onto the optical tube assembly and held in place with a safety screw (20, Fig. 4). The dew shield for the 7" APO telescope is shipped separately in carton #3. Use the following steps to attach the 7" dew shield:

1. Remove the dew shield safety screw from the bottom of the lens cell (2, Fig. 4).
2. Position the dew shield onto the end of the optical tube assembly, taking care to align the safety screw hole with the bottom of the lens cell.
3. Replace the dew shield safety screw.

Be sure that the dew shield safety screw is always in place whenever using any Meade apochromatic telescope.

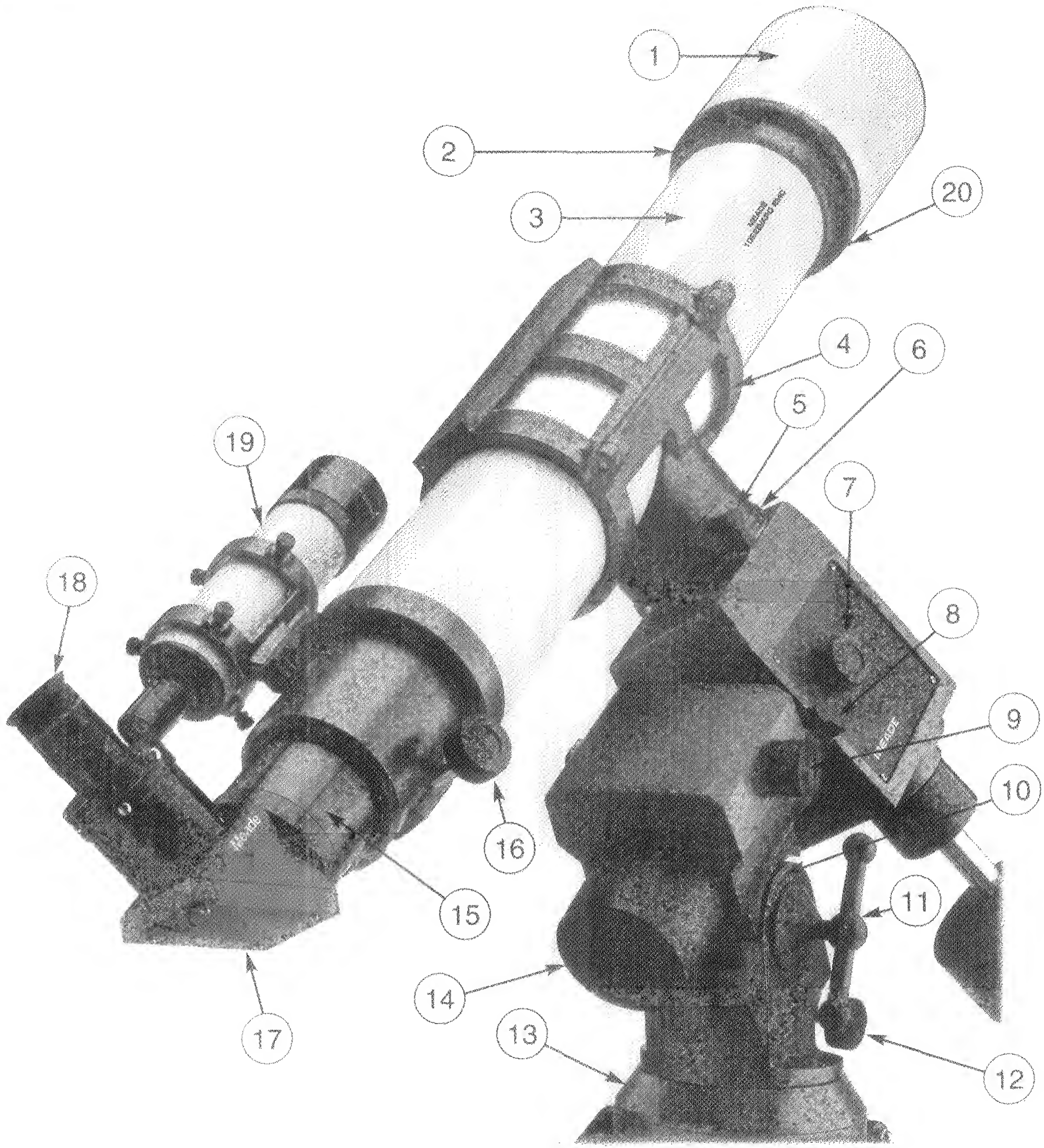
6. Mounting the Cradle Ring Assembly and OTA to the Equatorial Mount

The cradle ring assembly (4, Fig. 4) has been shipped on the optical tube assembly (OTA) (3, Fig. 4). Use the following procedure to attach the cradle rings to the equatorial head.

1. Loosen the two cradle ring knobs (16, Fig. 5) and remove the cradle ring assembly from the OTA.
2. Remove the two 3/8"-16 bolts from the top of the Declination cover casting (15, Fig. 5) and attach the cradle ring assembly using these two bolts. Firmly tighten these two bolts.

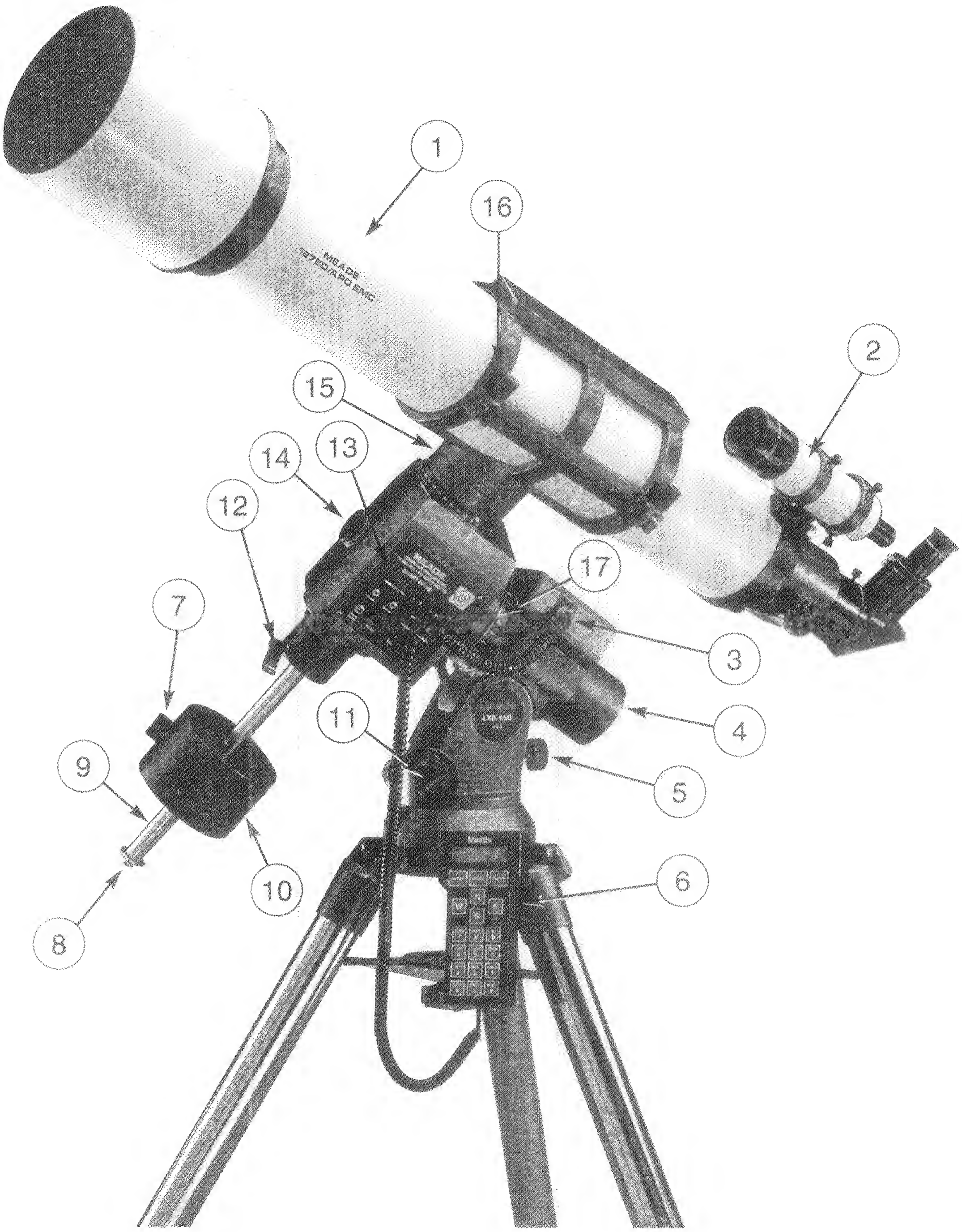
Once attached, the cradle ring assembly may be left permanently attached to the equatorial head.

3. Before placing the optical tube assembly into the cradle ring assembly (step 4, below), be certain that the R.A. lock lever (8, Fig. 4) and Dec. lock lever (5, Fig. 4) are firmly locked.
4. Place the optical tube assembly (3, Fig. 4) into the cradle ring assembly (16, Fig. 4) and secure by closing the cradle ring. Tighten the two cradle ring knobs.
5. Immediately perform the balancing procedure ("Balancing the Telescope") described on page 14.



(1) Dew Shield
(2) Lens Cell
(3) Optical Tube Assembly (OTA)
(4) Cradle Ring Assembly
(5) Declination Lock Lever
(6) Declination Setting Circle
(7) Declination Slow-Motion Knob
(8) R.A. Lock Lever
(9) R.A. Slow-Motion Knob
(10) Latitude Scale
(11) Latitude Lock Lever
(12) Azimuth Knob
(13) Field Tripod Adapter
(14) #814 Polar Alignment Viewfinder (Optional) R.A. Cover
(15) Focuser Drawtube
(16) Focuser Knob
(17) #930 Diagonal Mirror
(18) Eyepiece
(19) Viewfinder
(20) Dew Shield Safety Screw

Fig. 4: Apochromatic Refractor Equatorial Head



(1) Optical Tube Assembly (OTA)	(10) Counterweight
(2) Viewfinder	(11) Azimuth Control Knob
(3) R.A. Motor Cord (Optional)	(12) Counterweight Shaft Lock Lever
(4) #814 Polar Alignment Viewfinder (Optional) R.A. Cover	(13) #1664 Power Panel (Optional)
(5) Latitude Adjustment Knob	(14) #814 Polar Alignment Viewfinder (Optional) Dec. Cover
(6) EDS Hand Controller (Optional)	(15) Declination Cover Casting
(7) Counterweight Lock Lever	(16) Cradle Ring Knob
(8) Counterweight Safety Stop	(17) R.A. Setting Circle
(9) Counterweight Shaft	

Fig. 5: Apochromatic Refractor

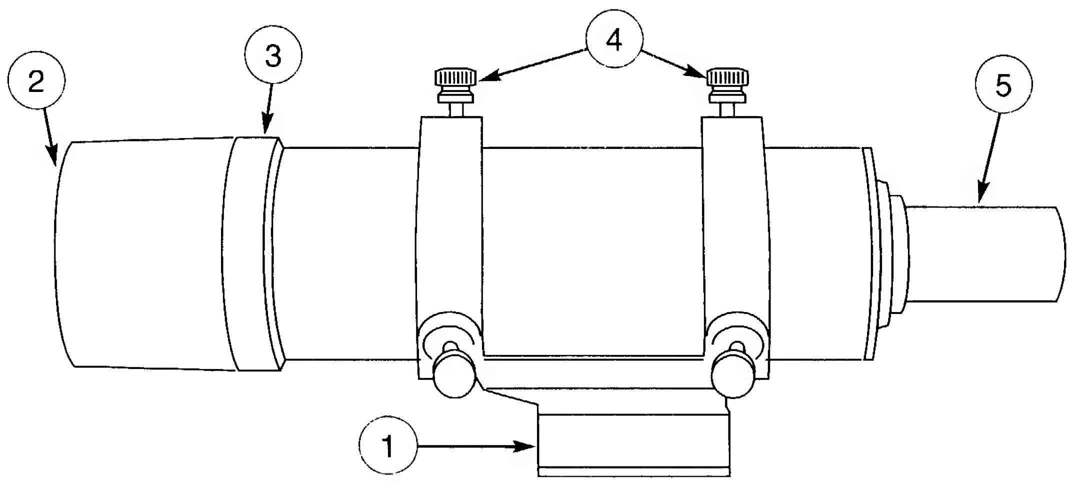
7. Mounting the Viewfinder

Each Meade APO telescope is supplied as standard equipment with an 8x50mm straight-through viewfinder. The bracket for this viewfinder is packed separately from the finder itself, and the 6 nylon thumbscrews for collimation should be threaded into the viewfinder bracket, securing the viewfinder in the bracket. The viewfinder bracket base has been factory-mounted to the main telescope's rear cell, and will accept the viewfinder and bracket directly, allowing quick removal for storage.

a. Attaching the Viewfinder

To attach the viewfinder, slide the viewfinder and bracket into the base and tighten the two thumbscrews (located on the viewfinder bracket base) to a "firm feel."

WARNING: Never use set screws on any part of the optical tube assembly, except those factory supplied set screws included with the basic telescope or with optional accessories. Longer, non-standard set screws may protrude too far into the optical tube and cause serious damage to the telescope.



(1) Bracket Slide
(2) Objective Lens Cell
(3) Focus Locking Ring
(4) Collimation Screws
(5) Eyepiece

Fig. 6: 8x50mm Viewfinder

b. Focusing the Viewfinder

The 8x50mm viewfinder has been factory pre-focused to infinity. Should this focusing need adjustment for your eyes, loosen the knurled collar at the objective lens-end of the viewfinder (3, Fig. 6), enabling rotation of the objective lens cell (2, Fig. 6) forward or backward for precise focusing. Then tighten down the knurled collar against the objective lens cell to lock the focus in place. Note that no focusing is possible or necessary at the eyepiece end of the viewfinder.

c. Collimating the Viewfinder

The viewfinder will require alignment, or collimation, with the main telescope. Using the 26mm eyepiece, point the main telescope at some easy to find land object (*e.g.* the top of a telephone pole or corner of a building) at least 200 yards distant. Center a well-defined object in the main telescope. Then, turn the 6 nylon collimation thumbscrews (4, Fig. 6) until the crosshairs of the viewfinder are precisely centered on the object already centered in the main telescope. With this collimation accomplished, objects located first in the wide-field viewfinder will then be centered in the main telescope's field of view.

8. Attaching Diagonal and Eyepiece

The #930 Diagonal Mirror (17, Fig. 4) slides into the focuser drawtube (15, Fig. 4) and, in turn, accepts the supplied 1 1/4" O.D. eyepiece. For astronomical observations, the diagonal mirror generally provides a more comfortable right-angle viewing position. Alternately, an eyepiece may be inserted directly into the focuser drawtube (using the diagonal mirror's 1 1/4" adapter) for straight-through observations*. Note in this case, however, that the image will appear inverted and reversed left-for-right. With the diagonal mirror, telescopic images appear correctly oriented up-and-down, but still reversed left-for-right. For terrestrial applications, where a fully corrected image orientation is desired, both up-and-down and left-for-right, the optional #924 or #928** Erecting Prism (1 1/4" O.D.) should be ordered separately. Eyepieces and the diagonal mirror are held in their respective places on the telescope by a moderate tightening of the thumbscrews on the diagonal mirror.

9. Balancing the Telescope

In order for the telescope to move smoothly on its mechanical axes, it must first be balanced, as follows:

1. Loosen the Right-Ascension (R.A.) lock (8, Fig. 4) and rotate the telescope so that the counterweight shaft (9, Fig. 5) is parallel to the ground (horizontal).
2. Loosen the counterweight lock lever(s) (7, Fig. 5) and slide the counterweight(s) along the shaft until the telescope remains in one position without tending to drift in either direction. Retighten the counterweight lock lever(s).
3. Loosen the Declination lock lever (5, Fig. 4) and rotate the optical tube assembly (OTA) so that the OTA is parallel with the ground (horizontal).
4. Loosen the two cradle ring lock knobs (16, Fig. 5) slightly and slide the OTA inside the cradle ring until the optical tube remains in one position without tending to fall in either direction. Retighten the cradle ring lock knobs, locking the OTA at this position.
5. The telescope is now properly balanced.

* Note, however, that straight-through observing through a Meade *ED* apochromatic refractor may require an optionally-available extension tube, in order to reach correct focus.

** See the latest Meade General Catalog.

C. TELESCOPE OPERATION

1. Your First Observations

With the telescope assembled as described in Section B, and with the diagonal mirror and eyepiece in place, your are ready to make observations through the telescope. Even without the viewfinder (if not yet installed), terrestrial objects will be fairly easy to locate and center in the telescope's field of view with a low power eyepiece, by "gunsighting" along the side of the main telescope tube.

IMPORTANT NOTE: NEVER POINT THE TELESCOPE DIRECTLY AT OR NEAR THE SUN, OR ATTEMPT TO OBSERVE THE SUN, EITHER THROUGH THE MAIN TELESCOPE OF THE VIEWFINDER. INSTANT AND IRREVERSIBLE DAMAGE TO YOUR EYE MAY OTHERWISE RESULT!

By unlocking the R.A. lock (8, Fig. 4), the telescope may be turned rapidly through wide angles in Right Ascension (R.A.). The reason for the terminology "Right Ascension" and its complementary term, "Declination" will be made clear further on in this manual. Fine adjustments in R.A. are made by turning the R.A. slow-motion knob (9, Fig. 4), while the R.A. lock is in the "locked" position.

Releasing the Declination lock (5, Fig. 4), permits sweeping the telescope rapidly through wide angles in Declination.

To use the Declination fine-adjust, or slow-motion control, lock the telescope in Declination using the Declination lock, and turn the Declination slow-motion knob. (7, Fig. 4).

With the above mechanical operations in mind, select and easy-to-find terrestrial object as your first telescope subject—for example, a house or building perhaps one-half mile distant.

Unlock the Dec. lock, and R.A. lock, center the object in the telescopic field of view and then re-lock the Dec. and R.A. locks. Precise image centering is accomplished by using the Dec. and R.A. slow motion controls.

Note: The R.A. and Dec. slow motion control knobs cannot be used when either of the optional #1697 CDS or #1664 EDS is operating. When power is supplied to the telescope, use the CDS keypad or EDS hand controller to make fine adjustments in R.A. or Declination. Forcing the manual control knobs when the motors are powered can cause damage to the gear system.

2. Focusing

The focus knob (16, Fig. 4) allows focusing the image. Focusing the telescope from its nearest possible focus point (on an object about 50 ft. to 150 ft. depending on the model) to an object at infinity requires a fairly large movement of the focuser drawtube. The focuser is designed to provide an extremely sensitive means of bringing an object into precise, sharp focus. After a specific object has been brought into focus, closer objects require moving the focuser drawtube outward; more distant objects require moving the drawtube inward.

3. Magnifications

The magnification, or power, of the telescope depends upon two optical characteristics: the focal length of the main telescope and the focal length of the eyepiece used during a particular observation. For example, the focal length of the 4" *f*/9 telescope is fixed at 920mm; the focal length of the 7" *f*/9 telescope is fixed at 1600mm. To calculate the power in use with a particular eyepiece, divide the focal length of the eyepiece into the focal length of the main telescope. For example, using the SP26mm eyepiece supplied with the 4" *f*/9, the power is calculated as follows:

$$\text{Power} = \frac{920\text{mm}}{26\text{mm}} = 35\text{x}$$

The type of eyepiece (whether "MA" Modified Achromatic or "OR" Orthoscopic, "SP" Super Plössl, etc.) has no bearing on magnifying power but does affect such optical characteristics as field of view, flatness of field and color correction.

The maximum practical magnification is determined by the nature of the object being observed and, most importantly, by the prevailing atmospheric conditions. Under very steady atmospheric "seeing," the 4" APO may be used at powers up to about 400X on astronomical objects, the 7" APO up to about 700X. Generally, however, lower powers of perhaps 250X to 350X will be the maximum permissible, consistent with high image resolution. When unsteady air conditions prevail (as witnessed by rapid "twinkling" of the stars), extremely high-power eyepieces result in "empty magnification," where the object detail observed is actually diminished by the excessive power.

See page 17 for additional information on eyepieces.

When beginning observations on a particular object, start with a low power eyepiece; get the object well-centered in the field of view and sharply focused. Then try the next step up in magnification. If the image starts to become fuzzy as you work into higher magnifications, then back down to a lower power — the atmospheric steadiness is not sufficient to support high powers at the time you are observing. Keep in mind that a bright, clearly resolved but smaller image will show far more detail than a dimmer, poorly resolved larger image.

Accessories are available both to increase and decrease the operating eyepiece power of the telescope. See your Meade dealer or the Meade General Catalog for information on accessories.

4. Apparent Field and Actual Field

Two terms that are often confused and misunderstood are "Apparent Field" and "Actual Field". "Apparent Field" is a function of the eyepiece design and is built into the eyepiece. While not totally accurate (but a very good approximation), "Apparent Field" is usually thought of as the angle your eye sees when looking through an eyepiece. "Actual Field" is the amount of the sky that you actually see and is a function of the eyepiece being used and the telescope.

The "Actual Field" of a telescope with a given eyepiece is calculated by knowing the "Apparent Field" and power of an eyepiece with a given telescope. The "Actual Field" of a telescope is calculated by taking the "Apparent Field" of the eyepiece and dividing by the power.

The following table lists the most common optional eyepieces available and the "Apparent Field" for each eyepiece. The power and "Actual Field" of view that each eyepiece yields is listed for each basic telescope optical design.

Eyepiece/Apparent Field	**4" APO (920mm)** Power/Actual Field	**5" APO (1140mm)** Power/Actual Field	**6" APO (1370mm)** Power/Actual Field	**6" APO (1370mm)** Power/Actual Field
Modified Achromatic Eyepieces (3-elements; 1 1/4" O.D.)				
40mm/36°	23/1.57°	29/1.26°	34/1.05°	40/0.90°
Orthoscopic Eyepieces (4-elements; 1 1/4" O.D.)				
4mm/45°	230/0.20°	285/0.16°	343/0.13°	400/0.11°
6mm/45°	153/0.29°	190/0.24°	228/0.20°	267/0.17°
9mm/45°	102/0.44°	127/0.36°	152/0.30°	178/0.25°
12.5mm/45°	74/0.61°	91/0.49°	110/0.41°	128/0.35°
18mm/45°	51/0.88°	63/0.71°	76/0.59°	89/0.51°
25mm/45°	37/1.22°	46/0.99°	55/0.82°	64/0.70°
Super Plössl Eyepieces (5-elements; 1 1/4" O.D., except as noted)				
6.4mm/52°	144/0.36°	178/0.29°	214/0.24°	250/0.21°
9 7mm/52°	95/0.55°	118/0.44°	141/0.37°	165/0.32°
12.4mm/52°	74/0.70°	92/0.57°	110/0.47°	129/0.40°
15mm/52°	61/0.85°	76/0.68°	91/0.57°	107/0.49°
20mm/52°	46/1.13°	57/0.91°	69/0.76°	80/0.65°
26mm/52°	35/1.47°	44/1.19°	53/0.99°	62/0.85°
32mm/52°	29/1.81°	36/1.46°	43/1.21°	50/1.04°
40mm/44°	23/1.91°	29/1.54°	34/1.28°	40/1.10°
56mm/52° (2" O.D.)	16/3.17°	20/2.55°	24/2.13°	29/1.82°
Super Wide Angle Eyepieces (6-elements; 1 1/4" O.D., except as noted)				
13.8mm/67°	67/1.01°	83/0.81°	99/0.67°	116/0.58°
18mm/67°	51/1.31°	63/1.06°	76/0.88°	89/0.75°
24.5mm/67°	38/1.78°	47/1.44°	56/1.20°	65/1.03°
32mm/67° (2" O.D.)	29/2.33°	36/1.88°	43/1.56°	50/1.34°
40mm/67° (2" O.D.)	23/2.91°	29/2.35°	34/1.96°	40/1.68°
Ultra Wide Angle Eyepieces (8-elements; 1 1/4" O.D., except as noted)				
4.7mm/84°	196/0.43°	243/0.35°	291/0.29°	340/0.25°
6.7mm/84°	137/0.61°	170/0.49°	204/0.41°	239/0.35°
8.8mm/84° (1 1/4" - 2" O.D.)	105/0.80°	130/0.65°	156/0.54°	182/0.46°
14mm/84° (1 1/4" - 2" O.D.)	66/1.28°	81/1.03°	98/0.86°	114/0.74°

5. Celestial Coordinates: Declination and Right Ascension

Analogous to the Earth-based coordinate system of latitude and longitude, celestial objects are mapped according to a coordinate system on the "celestial sphere," the imaginary sphere on which all stars appear to be placed. The Poles of the celestial coordinate system are defined as those 2 points where the Earth's rotational axis, if extended to infinity, North and South, intersect the celestial sphere. Thus, the North Celestial Pole is that point in the sky where an extension of the Earth's axis through the North Pole intersects the celestial sphere. In fact, this point in the sky is located near the North Star, or Polaris.

On the surface of the Earth, "lines of longitude" are drawn between the North and South Poles. Similarly, "lines of latitude" are drawn in an East-West direction, parallel to the Earth's equator. The celestial equator is simply a projection of the Earth's equator onto the celestial sphere. Just as on the surface of the Earth, imaginary lines have been drawn on the celestial sphere to form a coordinate grid. Celestial object positions on the Earth's surface are specified by their latitude and longitude.

The celestial equivalent to Earth latitude is called "Declination," or simply "Dec.," and is measured in degrees, minutes or seconds north ("+") or south ("-") of the celestial equator. Thus any point on the celestial equator (which passes, for example, through the constellations Orion, Virgo and Aquarius) is specified as having 0°0'0" Declination. The Declination of the star Polaris, located very near the North Celestial Pole, is +89.2°.

The celestial equivalent to Earth longitude is called "Right Ascension," or "R.A." and is measured in hours, minutes and seconds from an arbitrarily defined "zero" line of R.A. passing through the constellation Pegasus. Right Ascension coordinates range from $0^{hr}0^{min}0^{sec}$ up to (but not including) $24^{hr}0^{min}0^{sec}$. Thus there are 24 primary lines of R.A., located at 15 degree intervals along the celestial equator. Objects located further and further east of the prime ($0^h0^m0^s$) Right Ascension grid line carry increasing R.A. coordinates.

With all celestial objects therefore capable of being specified in position by their celestial coordinates of Right Ascension and Declination, the task of finding objects (in particular, faint objects) in the telescope is vastly simplified. The setting circles of the LXD650 and LXD750 mounts included with Meade apochromatic refractors may be dialed, in effect, to read the object coordinates and the object found without resorting to visual location techniques. However, these setting circles may be used to advantage only if the telescope is first properly aligned with the North Celestial Pole.

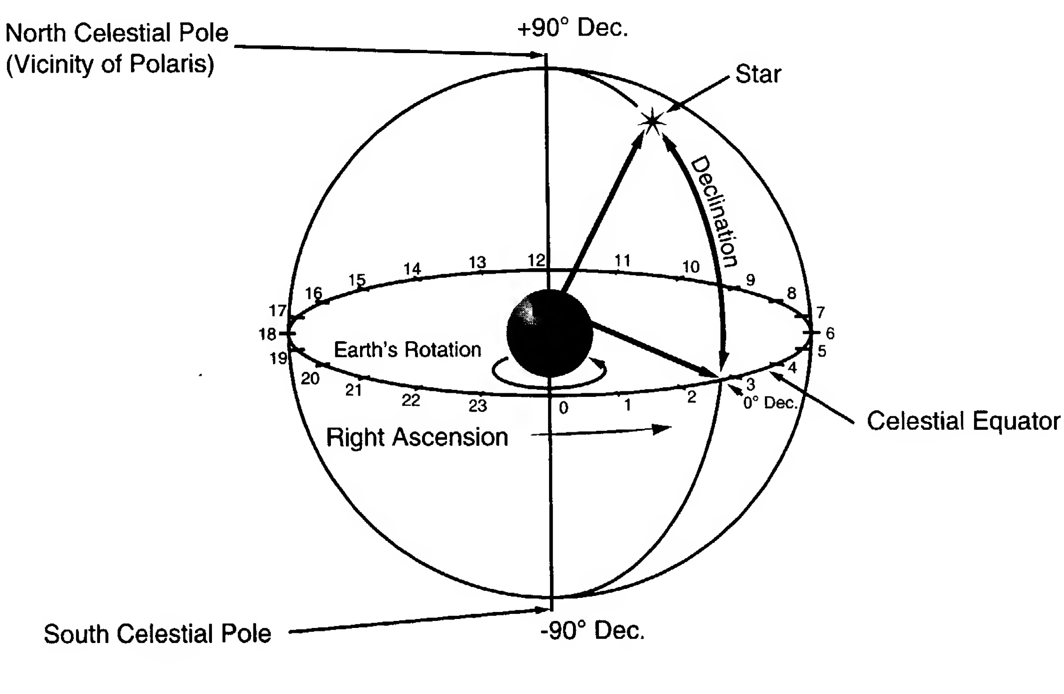


Fig. 7: Celestial Sphere

6. Lining Up With the Celestial Pole

Objects in the sky appear to revolve around the celestial pole. (Actually, celestial objects are essentially "fixed," and their apparent motion is caused by the Earth's axial rotation). During any 24 hour period, stars make one complete revolution about the pole, describing concentric circles with the pole at the center. By lining up the telescope's polar axis with the North Celestial Pole (or for observers located in Earth's Southern Hemisphere with the South Celestial Pole) astronomical objects may be followed, or tracked, simply by moving the telescope about one axis, the polar axis. In the case of the Meade APO refractor telescopes, this tracking may be accomplished automatically with optional electric motor drives.

If the telescope is reasonably well aligned with the pole, therefore, very little use of the telescope's Declination slow motion control is necessary—virtually all of the required telescope tracking will be in Right Ascension. (If the telescope were perfectly aligned with the pole, no Declination tracking of stellar objects would be required). For the purposes of casual visual telescopic observations, lining up the telescope's polar axis to within a degree or two of the pole is more than sufficient: with this level of pointing accuracy, one of the telescope's optional motor drives will track accurately and keep objects in the telescopic field of view for perhaps 20 to 30 minutes.

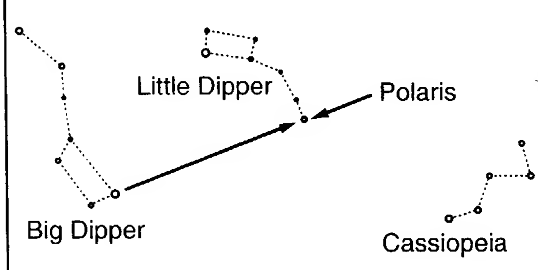


Fig. 8: Finding Polaris

Begin polar aligning the telescope as soon as you can see Polaris. Finding Polaris is simple. Most people recognize the "Big Dipper." The Big Dipper has two stars that point the way to Polaris (see Fig. 8). Once Polaris is found, it is a straightforward procedure to obtain a rough polar alignment.

To line up the telescope with the Pole, follow this procedure:

1. Using the bubble level located on the pier cap, adjust the tripod legs so that the telescope/tripod system reads "level."
2. Set the equatorial head to your observing latitude as described on page 10.
3. Loosen the Dec. lock (5, Fig. 4), and rotate the telescope tube in Declination so that the telescope's Declination reads 90°. Tighten the Dec. lock.
4. Using the Azimuth control knob (11, Fig. 5) and Latitude adjustment knob (5, Fig. 5), center Polaris in the field of view. Do not use the telescope's Declination or Right Ascension controls during this process.

At this point, your polar alignment is good enough for casual observations. There are times, however, when you will need to have precise polar alignment, such as when making fine astrophotographs or when using the setting circles to find new objects.

As an aside procedure, during your first use of the telescope, you should check the calibration of the Declination setting circle (6, Fig. 4). After performing the polar alignment procedure, center the star Polaris in the telescope field. Loosen slightly the knurled lock screw of the Declination setting circle. Now turn the circle unit until it reads 89.2°, the Declination of Polaris, and then tighten down the knurled lock screw, avoiding any motion of the circle.

Once the latitude angle has been fixed and locked-in according to the above procedure, it is not necessary to repeat this operation each time the telescope is used, unless you move a considerable distance North or South from your original observing position. (Approximately 70 miles movement in North-South observing position is equivalent to 1° in latitude change). The equatorial head may be detached from the field tripod and, as long as the latitude angle setting is not altered and the field tripod is leveled, it will retain the correct latitude setting when replaced on the tripod.

7. Precise Polar Alignment

It should be emphasized that precise alignment of the telescope's polar axis to the celestial pole for casual visual observations is not necessary. Don't allow a time-consuming effort at lining up with the pole to interfere with your basic enjoyment of the telescope. For long-exposure photography, however, the ground rules are quite different, and precise polar alignment is not only advisable, but almost essential.

Notwithstanding the precision and sophistication of the optional drive systems available for the Meade APO telescopes, the fewer tracking corrections required during the course of a long-exposure photograph, the better. (For our purposes, "long-exposure" means any photograph of about 10 minutes duration or longer). In particular, the number of Declination corrections required is a direct function of the precision of polar alignment.

Precise polar alignment requires the use of a crosshair eyepiece. Meade Illuminated Reticle Eyepieces are well-suited in this application, but you will want to increase the effective magnification through the use of a 2x or 3x Barlow lens. Then follow this procedure, sometimes better known as the "Drift" method:

1. Obtain a rough polar alignment as described earlier. Place the illuminated reticle eyepiece (or eyepiece/Barlow combination) into the eyepiece holder of the telescope.
2. Point the telescope, with the motor drive running, at a moderately bright star near where the meridian (the North-South line passing through your local zenith) and the celestial equator intersect. For best results, the star should be located within ±30 minutes in R.A. of the meridian and within ±5° of the celestial equator. (Pointing the telescope at a star that is straight up, with the Declination set to 0°, will point the telescope in the right direction.)
3. Note the extent of the star's drift in Declination (disregard drift in Right Ascension):
   a. If the star drifts South (or down), the telescope's polar axis is pointing too far East (Fig. 9).
   b. If the star drifts North (or up), the telescope's polar axis is pointing too far West (Fig. 10).

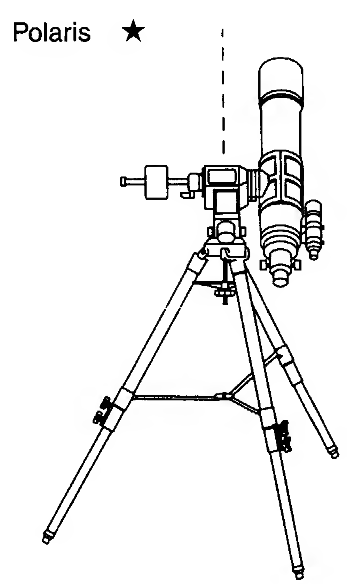


Fig. 9: Mount Too Far East

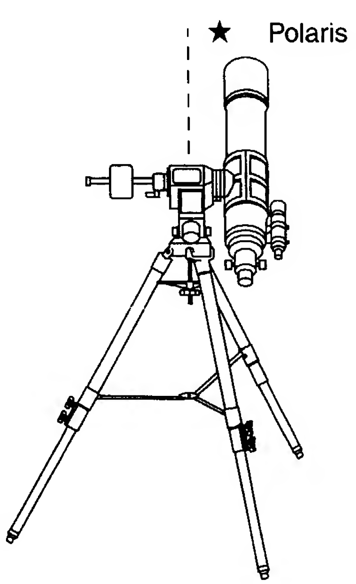


Fig. 10: Mount Too Far West

4. Move the wedge in azimuth (horizontally) to effect the appropriate change in polar alignment. Reposition the telescope's East-West polar axis orientation until there is no further North-South drift by the star. Track the star for a period of time to be certain that its Declination drift has ceased.

5. Next, point the telescope at another moderately bright star near the Eastern horizon, but still near the celestial equator. For best results, the star should be about 20° or 30° above the Eastern horizon and within ± 5° of the celestial equator.

6. Again note the extent of the star's drift in Declination:
   a. If the star drifts South, (or down) the telescope's polar axis is pointing too low (Fig. 11).
   b. If the star drifts North, (or up) the telescope's polar axis is pointing too high (Fig. 12).

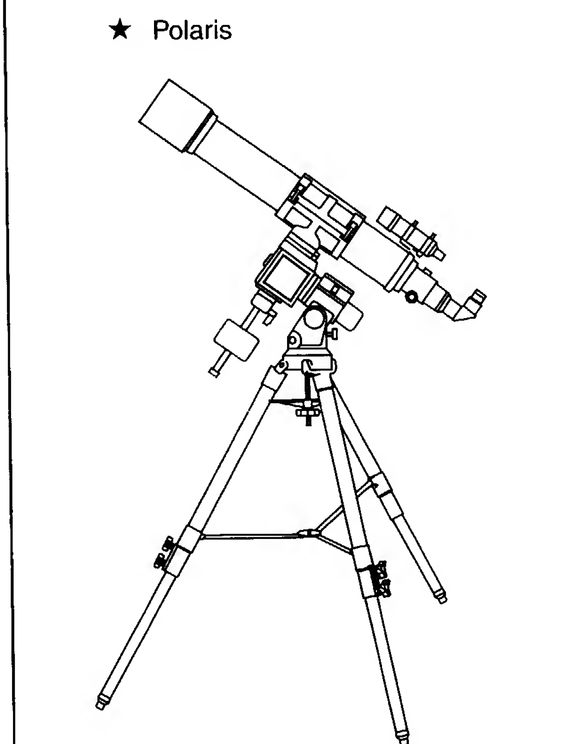


Fig. 11: Mount Too Low

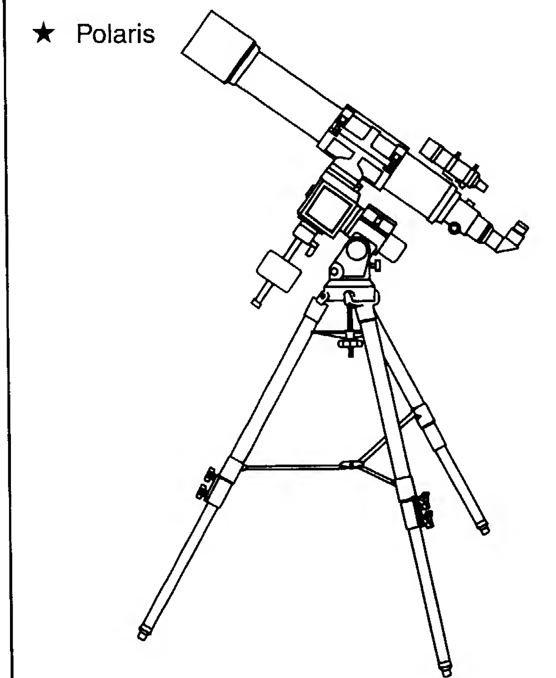


Fig. 12: Mount Too High

7. Use the latitude angle fine-adjust control (5, Fig. 5) to effect the appropriate change in latitude angle, based on your observations above. Again, track the star for a period of time to be certain that Declination drift has ceased.

The above procedure results in very accurate polar alignment, and minimizes the need for tracking corrections during astrophotography.

In addition to the drift method described above, two optional accessories can be used to achieve a precise polar alignment. The optional #814 Polar Alignment Finder is a borescope device which uses an internal etched reticle showing where to place the North Star to align the telescope. And the #1697 Computer Drive/Slew System has a computerized polar alignment routine that automates the complete process, allowing very fast, precise polar alignment. See the Meade General Catalog for complete details.

8. Setting Circles

Setting circles included with Meade *ED* apochromatic telescopes and equatorial mounts permit the location of faint celestial objects not easily found by direct visual observation. With the telescope pointed at the North Celestial Pole, the Dec. circle should read 90° (understood to mean +90°). Objects located below the 0-0 line of the Dec. circle carry minus Declination coordinates. Each division of the Dec. represents a 1° increment. The R.A. circle runs from 0^{hr} to (but not including) 24^{hr}, and reads in increments of 5^{min}.

Note that the R.A. circle (17, Fig. 5) is double-indexed, *i.e.,* there are 2 series of numbers running in opposite directions around the circumference of the R.A. circle. The upper series of numbers (increasing counterclockwise) applies to observers located in the Earth's Northern Hemisphere; the lower series of numbers (increasing clockwise) applies to observers located in the Earth's Southern Hemisphere.

With the telescope aligned to the pole, center an object of known R.A. in the telescopic field. Then turn the R.A circle, which can be rotated manually, until the R.A. coordinate of the object is correctly indicated by the R.A. pointer. As long as the telescope's motor drive remains "ON," the R.A. pointer will then correctly indicate the R.A. of any object at which the telescope is pointed throughout the duration of the observing session.

To use the circles to locate a particular object, first look up the celestial coordinates (R.A. and Dec.) of the object in a star atlas. Then loosen the R.A. lock and turn the telescope to read the correct R.A. of the desired object; lock the R.A. lock onto the object. Next, turn the telescope in Declination to read the correct Declination of the object. If the procedure has been followed carefully , and if the telescope was well-aligned with the pole, the desired object should now be in the telescopic field of a low-power eyepiece.

If you do not immediately see the object you are seeking, try searching the adjacent sky area, using the R.A. and Dec. slow-motion controls to scan the surrounding region. Keep in mind that with the 26mm eyepiece, the field of view of the telescope is less than 1°. Because of its much wider field, the viewfinder may be of significant assistance in locating and centering objects, after the setting circles have been used to locate the approximate position of the object.

Pinpoint application of the setting circles requires that the telescope be precisely aligned with the pole. Refer to the preceding section on "Precise Polar Alignment," page 20 for further details.

The setting circles may be used with or without an optional motor drive system. As you track the object, whether by turning the R.A. slow-motion control knob or using an optional motor drive system, the setting circles keep position with the object.

9. Observing with the Telescope

Meade APO telescopes permit an extremely wide array of serious observational opportunities. Even in normal city conditions, with all of the related air and light pollution, there are a good many interesting celestial objects to observe. But to be sure, there is no substitute for the clear, steady, dark skies generally found only away from urban environments, or on mountain tops: objects previously viewed only in the city take on added detail or are seen in wider extension, or even become visible at all for the first time.

The amateur astronomer is faced typically with two broadly defined problems when viewing astronomical objects through the Earth's atmosphere: first is the clarity, or transparency, of the air and, secondly the steadiness of the air. This latter characteristic is often referred to as the quality of "seeing." Amateur astronomers talk almost constantly about the "seeing conditions," since, perhaps ironically, even the clearest, darkest skies may be almost worthless for serious observations if the air is not steady. This steadiness of the atmosphere is most readily gauged by observing the "twinkling" of the stars: rapid twinkling implies air motion in the Earth's atmosphere, and under these conditions resolution of fine detail (on the surface of Jupiter, for instance) will generally be limited. When the air is steady, stars appear to the naked eye as untwinkling points of unchanging brightness and it is in such a situation that the full potential of the telescope may be realized: higher powers may be used to advantage, closer double stars are resolved as distinct points and fine detail may be observed on the Moon and planets.

Several basic guidelines should be followed for best results in using your telescope:

1. Try not to touch the eyepiece while observing. Any vibrations resulting from such contact will immediately cause the image to move.
2. Allow your eyes to become "dark adapted" prior to making serious observations. Night adaptation generally requires about 10 to 15 minutes for most people.
3. Let the telescope "cool down" to the outside environmental temperature before making observations. Temperature differentials between a warm house and cold outside air require about 30 minutes for the telescope's optics to regain their true and correct figures. During this period, the telescope will not perform well. A good idea is to take the telescope outside 30 minutes before you want to start observing.
4. If you wear glasses and do not suffer from astigmatism, take your glasses off when observing through the telescope. You can re-focus the image to suit your own eyes. Observers with astigmatism, however, should keep their glasses on since the telescope cannot correct for this eye defect.
5. Avoid setting up the telescope inside a room and observing through an open window (or worse yet, through a closed window!). The air currents caused by inside/outside temperature differences will make quality optical performance impossible.
6. Perhaps most importantly of all, avoid "overpowering" your telescope. The maximum usable magnification at any given time is governed by seeing conditions. If the telescopic image starts to become fuzzy as you increase in power, drop down to a reduced magnification. A smaller but brighter and sharper image is far preferable to a larger but fuzzy and indistinct one.
7. As you use your telescope more and more, you will find that you are seeing finer detail: observing through a large aperture telescope is a required skill. Celestial observing will become increasing rewarding as you eye becomes better trained to the detection of subtle nuances of resolution.

D. MAINTENANCE

1. Keeping Your Telescope Clean

Prevention is the best recommendation that a telescope owner can follow in keeping astronomical equipment in top working order. Proper measures taken during observations and when storing the equipment between observation runs can add many years of trouble free use.

Dust and moisture are the two main enemies to your instrument. When observing, always the Dew Shield (1, Fig. 4). The Dew Shield not only helps prevent dew from forming, and dust from settling on the lens, it prevents stray light from reducing image contrast.

Although dew shields go a long way to prevent moisture build-up, there can be times when the telescope optics will have a uniform coating of moist dew. This is not particularly harmful, as long as the dew is allowed to evaporate from the instrument, accomplished by setting up the telescope indoors with the dust covers removed.

Never attempt to wipe down optics that are covered with dew. Dust and dirt may be trapped with the collected dew, and upon wiping the optics you may scratch them. After the dew has evaporated you will most likely find them in fine condition for the next observing session.

If you live in a very moist climate, you may find it necessary to use silica dessicant stored in the telescope's case to ward off moisture and the possibility of fungus growing on and within the coatings of the optics. Replace the silica dessicant as often as necessary.

Those living in coastal areas or tropic zones should also cover the electronic ports on the optional Power Panel and the Keypad with gaffers tape to reduce corrosion on the metal contacts. Apply a dab of a water displacement solution (such as WD-40) with a small brush on all of the interior metal contacts and the input cord metal contacts. The Keypad and all separate accessories should be kept in sealable plastic bags with silica dessicant.

A thick layer of dust will attract and absorb moisture on all exposed surfaces. Left unattended, it can cause damaging corrosion. To keep dust at bay when observing, the telescope can be set up on a small section of indoor/ outdoor carpet. If you are observing for more than one night in a row, the telescope can be left set up but covered with a large plastic bag (such as the one supplied with the telescope). Eyepieces, diagonals, and other accessories are best kept in plastic bags and stored in cases, such as the Meade #50 Accessory Case*.

All of the non optical surfaces of the telescope should be cleaned routinely with a soft rag and alcohol to prevent corrosion. The cast metal surfaces and the individual exposed screws can also be kept looking new and corrosion-free by wiping them down with a water displacement solution (such as WD-40). Take care not to smear the solution onto any optical surface, and to wipe up any excess solution with a clean dry cloth. The painted tube can be polished with a liquid car polish and a soft rag.

Surprisingly, the most common telescope maintenance error is cleaning the optics too often. A little dust on any of the optical surfaces causes virtually zero degradation of optical performance. It should be of no concern whatsoever to see some small particles on the inside or outside of telescope optics. Should the optics get more dust on them than you would care for, simply use a photographic grade camel hair brush with very gentle strokes. You can also blow off dust with an ear syringe (available from a local pharmacy).

There is a point, however, when the optics must be cleaned. This is when you can easily tell that there is a thin layer of fine particulates that make the optics look very slightly hazy. When the objective lens of the telescope requires cleaning, the optical tube assembly should be returned to Meade Instruments (see page 25), where the optics will be professionally disassembled and cleaned for a reasonable charge. **Do not attempt to disassemble or clean the lenses yourself. Disassembling, cleaning, reassembling, and collimating an apochromatic lens is a task properly performed only by specially-trained technicians.**

* See the Meade General Catalog for complete details.

2. Factory Servicing and Repairs

Meade apochromatic refracting telescopes have been designed and manufactured for years of trouble-free operation and repairs should rarely be necessary. If a problem does occur, first write or call our Customer Service Department. Do not return the telescope until you have communicated with us in this way, since the great majority of the problems can be handled without the return of the telescope to us. However, should the occasion arise that the instrument requires factory servicing, a Meade Instruments Customer Service Representative will issue a Return Goods Authorization (RGA) number and give you full instructions on how to use it. Returning a telescope without the RGA may greatly delay any servicing or repairs. When telephoning or writing, please explain the exact nature of the problem so that we may offer a prompt remedial procedure. Be sure to include your full name, address, phone and fax numbers where you can be reached.

Should you live outside of the United States, contact your Authorized Meade Distributor from whom you purchased the instrument.

You can reach the Meade Instruments Customer Service Department either by mail, phone, or fax at: Meade Instruments Corporation, 6001 Oak Canyon, Irvine, CA 92618-5200, telephone (949) 451-1450, or telefax (949) 451-1460. Outside of the U.S.A., dial your International Access Code, then 1, then the ten digit number above in the 714 area code.

E: LX50 SPECIFICATIONS

Telescope	4" Model 102ED	5" Model 127ED	6" Model 152ED	7" Model 178ED
Optical Design	2-element ED Apochromat	2-element ED Apochromat	2-element ED Apochromat	2-element ED Apochromat
Clear Aperture	102mm (4")	127mm (5")	152mm (6")	178mm (7")
Diameter	110mm	135mm	160mm	188mm
Focal Length	920mm (36.2")	1140mm (44.9")	1370mm (53.9")	1600mm (63.0")
Focal Ratio	*f*/9	*f*/9	*f*/9	*f*/9
Resolution	1.1 arc sec	0.9 arc sec	0.74 arc sec	0.64 arc sec
Super Multi-Coatings	Standard	Standard	Standard	Standard
Limiting Visual Magnitude (approx)	12.0	12.8	13.5	13.8
Limiting Photographic Magnitude (approx)	14.5	15.3	16.0	16.3
Image Scale (°/inch)	1.56°/inch	1.26°/inch	1.05°/inch	0.90°/inch
Maximum Practical Visual Power	400x	500x	600x	700x
Near Focus	50'	75'	100'	150'
Optical Tube Size	4.5" Dia. x 31.5" Long	5.5" Dia. x 40.75" Long	7" Dia. x 51" Long	8" Dia. x 59.5" Long
Dew Shield	5.5" Dia. x 5.5" Long	7" Dia. x 7" Long	8.25" Dia. x 8.5" Long	9.8" Dia. x 10" Long
Focusing Mechanism	2.7 I.D.; 4" travel	2.7 I.D.; 4" travel	2.7 I.D.; 4" travel	2.7 I.D.; 4" travel
Eyepiece Holder	2", with 1.25" adapter	2", with 1.25" adapter	2", with 1.25" adapter	2", with 1.25" adapter
Diagonal Mirror	2" #930	2" #930	2" #930	2" #930
Telescope Mounting	LXD 650; German-type	LXD 650; German-type	LXD 750; German-type	LXD 750; German-type
Ball Bearings	8 - 2.25" dia.	8 - 2.25" dia.	8 - 3.1" dia.	8 - 3.1" dia.
Tripod	Standard Field Tripod	Standard Field Tripod	Standard Field Tripod	Standard Field Tripod
Tripod Legs motor; 5.75" worm gear	Inner Leg: 1.5" O.D.; Outer Leg: 2.0" O.D.	Inner Leg: 1.5" O.D.; Outer Leg: 2.0" O.D.	Inner Leg: 2" O.D.; Outer Leg: 3" O.D.	Inner Leg: 2" O.D.; Outer Leg: 3" O.D.
Tripod Height	30" - 44" variable	30" - 44" variable	40" - 50" variable	40" - 50" variable
Counterweights	1 - 10#	1 - 15#	1 - 25#	1 - 25# & 1 - 12#
Worm Gear Diameters	R.A. & Dec. 2.8"	R.A. & Dec. 2.8"	R.A. & Dec. 3.75"	R.A. & Dec. 3.75"
Setting Circle Diameters	Dec.: 4.15"; R.A.: 4"	Dec.: 4.15"; R.A.: 4"	Dec.: 5"; R.A.: 4.75"	Dec.: 5"; R.A.: 4.75"
Hemispheres of Operation	North and South switchable	North and South switchable	North and South switchable	North and South switchable
Latitude Range	15° to 60°	15° to 60°	15° to 60°	15° to 60°
Manual Slow-Motion Controls	Dec. and R.A.	Dec. and R.A.	Dec. and R.A.	Dec. and R.A.
Objective Lens	KF3; ED/FK01	KF3; ED/FK01	KF3; ED/FK01	KF3; ED/FK01
Optional Drive System	#1664 EDS or #1697 CDS	#1664 EDS or #1697 CDS	#1664 EDS or #1697 CDS	#1664 EDS or #1697 CDS
35mm Angular Film Coverage	2.15° x 1.49°	1.74° x 1.71°	1.44° x 1.00°	1.24° x 0.86°
Net Telescope Weights (approx)				
Telescope	41#	50#	90#	113#
Field Tripod	20#	20#	20#	20#
Accessories	8#	8#	8#	8#
Shipping Weights (approx)				
Telescope	50#	60#	114#	141#
Field Tripod (optional)	26#	26#	26#	26#
Accessories	10#	10#	10#	10#